INSTITUTE OF PUBLIC HEALTH
COLLEGE OF MEDICINE AND HEALTH SCIENCES
UNIVERSITY OF GONDAR

PATTERNS AND VISUAL OUTCOMES OF EYE INJURIES AMONG PATIENTS TREATED AT UNIVERSITY OF GONDAR REFERRAL HOSPITAL, NORTH WEST ETHIOPIA

BY: SISAY YOSEPH (Ophthalmic officer)

ADVISOR: BERIHUN MEGABIAW (MD, MPH)

A THESIS SUBMITTED TO THE INSTITUTE OF PUBLIC HEALTH, COLLEGE OF MEDICINE AND HEALTH SCIENCES, UNIVERSITY OF GONDAR IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH IN EPIDEMIOLOGY AND BIOSTATISTICS.

June, 2012
Gondar, Ethiopia

UNIVERSITY OF GONDAR
COLLEGE OF MEDICINE AND HEALTH SCIENCES
INSTITUTE OF PUBLIC HEALTH

PATTERNS AND VISUAL OUTCOMES OF EYE INJURIES AMONG PATIENTS TREATED AT GONDAR UNIVERSITY REFERRAL HOSPITAL, NORTH WEST ETHIOPIA

Principal Investigator: Sisay Yoseph (Ophthalmic officer)

Tel: *+251-912-16-02-49*

Email: **sisayjoseph@ymail.com**

Department of Ophthalmology, University of Gondar

Approved by the Examining Board

---------- ----------

Head, Institute of public Health

Advisor:

Berihun Megabiaw (MD, MPH) ----------

---------- ----------

Examiner

ACKNOWLEDGMENTS

My heart felt appreciation goes to my advisor, Dr Berihun Megabiaw for his unreserved advice and comment. Had it not been for his help, this study would not have been undertaken.

I am also thankful to Dr. Yared Asefa and Dr.Hardeep Rai Sharma for reviewing and providing invaluable comments and supports.

My appreciation also extends to my friends and all staff of ophthalmology and optometry departments.

LIST OF ACRONYMS

CGI	Closed Globe Injury
HM	Hand Motion
IOFB	Intra Ocular Foreign Body
LP	Light Perception
LP-	Light Perception without projection
LP+	Light Perception with projection
NLP	No Light Perception
OGI	Open Globe Injury
RD	Retinal Detachment
VA	Visual Acuity
VH	Vitreous Hemorrhage

TABLE OF CONTENTS

Contents Page Number

ACKNOWLEDGMENTS I
LIST OF ACRONYMS II
LIST OF TABLES V
LIST OF FIGURES VI
LIST OF ANNEXES VII
ABSTRACT VIII
1. INTRODUCTION 1
1.1 Statement of the Problem 1
1.2. Literature Review 3
1.3. Justification of the Study 5
2. OBJECTIVES: 6
2.1 General objective: 6
2.2 Specific objectives: 6
3. METHODS 7
3.1 Study design: 7
3.2 Study area and study period: 7
3.3 Source population 7
3.4 Study population: 7
3.5 Study variables: 7
3.5.1 Dependent variable: 7
3.5.2 Independent variables 8
3.6 Operational definitions 8
3.7 Sampling Procedure: 9
3.8 Data collection procedure: 9
3.9 Data quality control: 9
3.10 Data management and analysis: 9
4. ETHICAL CONSIDERATION 10
5. RESULTS 11
5.1 Socio demographics 11
5.2 Characteristics of injury 11

5.3 Time of presentation 14
5.4 Treatment Modalities and complications 15
5.5 Follow-up 15
5.6 Visual outcomes 15
5.7 Factors associated with Visual outcome 16
6. DISCUSSION 20
7. LIMITATIONS AND STRENGTH OF THE STUDY 22
8. CONCLUSION 23
9. RECOMMENDATIONS 23
10. REFERENCES 24
11. ANNEXES 26
Appendix 1: Data collection format 26
Appendix 2: Information sheet 28
Appendix 3: Conceptual framework 30
Appendix 4: Declaration 31

LIST OF TABLES

Table 1:Distribution of cases seen at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012----------11

Table 2:Distribution of Globe injuries among patients seen at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012----------13

Table 3: causes of injuries among patients treated at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012----------13

Table 4: Type of injuries and visual outcome of cases seen at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012----------16

Table 5: Factors associated with visual outcome of eye injuries among patients treated at University of Gondar Referral Hospital,Northwest Ethiopia,between September 2008 to February 2012, result from logistic regression analyses----------18

LIST OF FIGURES

Figure 1: Type of injury by gender of patients seen at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012----------12

Figure 2: Time from injury to ophthalmic assessment in patients treated at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012----------14

LIST OF ANNEXES

Appendix 1: Data collection format----------26

Appendix 2: Information sheet----------28

Appendix 3: Conceptual framework showing factors associated With the visual outcome of eye injury----------30

Appendix 4: Declaration ----------31

ABSTRACT

Background: Adequate information on globe injuries particularly on the outcomes and prognostic factors is lacking in Ethiopia.

Objective: The objective of this study was to assess the patterns, prognostic factors and visual outcomes of patients with globe injuries in Gondar University Referral Hospital.

Method: Records of patients who sustained either open or closed type of globe injury and treated at Gondar University Referral Hospital between September 2008 and February 2012 were reviewed retrospectively. The Birmingham Eye Trauma Terminology (BETT) was used to classify types of globe injuries. The data were collected by one cataract surgeon, one ophthalmic officer and an optometrist. Demographic factors, time-duration to treatment and intraocular factors were assessed. Epi Info version 2000 was used for data entry. Binary logistic regression was used to determine factors associated with a visual outcome of less than 3/60(blindness) on the affected eye. A p-value of <0.05 was considered statistically significant.

Result: Two hundred and forty five cases were identified, 124(50.6%) closed-globe, and 121(49.4%) open-globe injuries. The male to female ratio was 4.7:1. The median age of patients was 22 years (Range: 4 to 78 years). Wood, Stone and metal were the cause of injury in 78 (31.8%), 59(24.1%) & 26(10.6%) cases respectively. After treatment, 121(49.4%) cases remained blined in the injured eye. A visual acuity of 6/18 or better were achieved in 62 eyes (25.3%), <6/18 – 3/60 in 62 eyes (25.3%). Sixteen eyes(6.53%) were eviscerated.Type of injury (closed globe Vs open globe) and presenting visual acuity were the most important predictors of blindness (VA<3/60) on the affected eye (P<0.0001).

Conclusion: young individuals were the commonly affected groups. Open globe injuries had a poorer visual prognosis. Presenting visual acuity and type of injury were important prognostic factors of visual outcomes. Nearly 50% of cases remained blind after treatment, indicating the need for strengthening our effort on the prevention aspect.

1. INTRODUCTION

1.1 Statement of the Problem

Eye injuries are worldwide preventable causes of visual impairment[1, 2]. Eye injury is a leading cause of monocular visual impairment in Ethiopia[3].The severity of globe injuries ranges from minor scratches to serious trauma resulting in blindness[4]. At the global level, each year an estimated 55 million people suffer from globe injuries which results in restriction of activities for more than one day, and 750,000 injured individuals along with 200,000 patients with open-globe injuries require hospitalization Worldwide, about 1.6 million people are known to be blind due to globe injury and other 19 million individuals are assumed to have monocular blindness or low vision[5].

In addition to its functional and cosmetic effect on the injured individual, the impact of globe injury extends to social level in terms of loss productivity and added costs to health care system. The health related cost of eye injury is more severe in developing countries where there is lack of preventive eye care service at all levels[6]. The annual direct and indirect financial costs of globe injury run into hundreds of millions of dollars. In United States alone, each year the medical expense and workers' compensation due to eye injuries cost more than 300 million dollar[7]. The pattern and causation of globe injuries may vary between populations and can be influenced by change in the environment, culture, education and government policy[8]. Different places and activities such as, work place, home, sport related activities, assault, and traffic accidents are the common predisposing factors of globe injury[9]. Young males are more prone to injury than others[10], and this is attributed to the relatively higher tendency of males for risk taking behavior and their involvement in assault and risky sport activities[4, 11].

The mechanism and type of injury, the extent of damage, and the time lapse between the occurrence of injury and eye care are among the factors that determine the visual outcome of globe injuries[12, 13].

Ninety percent of eye injuries are preventable[10]. To design preventive strategy and to provide clinical care the availability of data regarding the overall nature of injury and its

impact interms of visual outcome is very important. However, adequate data regarding the pattern and visual outcome of globe injuries are lacking in developing countries including Ethiopia. Moreover, no study has been conducted in this regard in the Northwest part of Ethiopia. Hence, the purpose of this study is to assess the pattern and visual outcomes of globe injuries in patients treated at Gondar University Referral Hospital.

1.2. Literature Review

Globe injury is a global health issue[1]. The risk of eye injury tends to be higher in males than females and this preponderance has been consistently reported in several previous studies [14-17]. A six fold higher rate of eye injury in males than females was reported from a prospective study in Malaysia[1].Similarly, a male-to-female ratio of 3.2:1 and 3:1 were reported from studies conducted in Ethiopia[18, 19]. The male predominance is also a common feature among children as it was shown in a hospital-based study in South Africa which revealed a male to female ratio of 2.3:1 among children that were hospitalized due to penetrating eye injury[20].

In Ethiopia the magnitude of eye injury in the general population is not clearly known as most of the studies were conducted in health facilities. In a recent retrospective study from Jimma University, Tsedeke et al, reported that eye injury accounted for 6.9% of all ocular diseases seen in two year period at Jimma University Specialized Hospital[18].

With regard to the age distribution pattern of eye injuries, in previous study the average age was reported to be 30 years[1].In United States, the rate of injury was reported to be highest in males who were in their 20s and 30s[21].Similarly, In Egypt, the average age of sustaining trauma was reported to be 22 years[16].In Ethiopia, an average age of 19.4, 25.5 and 27 years were reported from studies conducted at Menelic II, Jimma and Grarbet hospital respectively[12, 18, 19].

Regarding the types of injury, closed globe injuries were reported to be the most prevalent types compared with open injuries from a historical cohort study conducted in India[22]. Another study from Queensland also reported that closed globe injuries commonly occurred than open globe injuries[23].In contrast to the above mentioned findings, in studies from Ghana and Egypt, open-globe injuries were known to be the most common types than closed globe injuries[6, 16].

The seasonal pattern of Globe injuries have been reported in a study conducted in Turkey[24]. Similarly in a prospective study done in Grarbet, the incidence of eye injuries showed seasonal variation related to agricultural activities[19].

The visual outcome of patients with globe injuries varies from full recovery to complete blindness and can be influenced by several factors. Several studies have suggested different factors that can help predict the visual outcome of globe injuries [14, 25-30].

In most studies, poor visual outcome after globe injury was strongly associated with poor initial visual acuity[14, 28, 31], the presence of afferent papillary defect[28], increased age[32], mechanism of trauma[12], location of wound[29, 33], type of injury[22, 23], lid laceration,iris damage, lens damage, hyphema, vitreous hemorrhage, Intra Ocular Foreign Body(IOFB), retinal detachment[14, 28], type of treatment[34],and endophthalmitis[14].

Open globe injuries were reported to have poor prognosis in previous study[23]. On the other hand, closed globe and self sealing corneal injuries were found to have good visual prognosis[34].

1.3. Justification of the Study

Globe injuries are major public health problems and prevalent in all societies. However, the health and socioeconomic impacts of globe injuries can be prevented or controlled by designing effective strategies on the prevention and management of cases based on the pattern and clinical nature of injuries.

In most developing countries like Ethiopia, adequate data on globe injuries are not available. Hence, this study aims to provide data on the pattern, visual outcome and prognostic indicators of visual outcomes in globe injuries in order to inform the concerned bodies and clinicians with information about the pattern and visual impact of globe injuries for designing prevention strategies and patient counceling.

2. OBJECTIVES:

2.1 General objective:

To assess patterns, visual outcomes and associated factors among patients with Eye injuries treated at Gondar University Referral Hospital, Northwest Ethiopia, 2012.

2.2 Specific objectives:

- To determine patterns of Globe injuries
- To determine the visual outcomes of Globe injuries
- To find out factors associated with visual outcomes in globe injuries

3. METHODS

3.1 Study design:

A hospital based review of the medical records of patients with globe injury was conducted at the University of Gondar Referral Hospital, North West Ethiopia.

3.2 Study area and study period:

The study was conducted at the University of Gondar Referral Hospital, Ophthalmology Department from February to May 2012. Gondar University Referral hospital is located in North Gondar Zone at about 727 kilometers North-West of Addis Ababa, the capital city of Ethiopia. The ophthalmology department is a tertiary level eye care centre that serves about 15 million people for the North-West part of Ethiopia with its staff including 5 ophthalmologists, 3 general practitioner, 5 ophthalmic officers and 1 cataract surgeon.

3.3 Source population

All cases of eye injuries presented to the department of ophthalmology during September 2008 to February 2012.

3.4 Study population:

All cases of globe injuries that were treated within a period from September 2008 to February 2012 at the Department of Ophthalmology,University of Gondar Referral Hospital.

Inclusion criteria: all consecutive cases who sustained mechanical injury of the Globe in the aforementioned period and those whose medical records were retrieved.

Exclusion criteria:

- Patients who underwent Surgical repair at other hospital
- Unrecorded presenting and final visual acuity

3.5 Study variables:

3.5.1 Dependent variable: visual outcome

3.5.2 Independent variables:

- **Socio-demographic**
  - Age
  - Sex
  - Area of residence

- **Intraocular factors**
  - Hyphema
  - Iris injury
  - Lens injury
  - Vitreous hemorrhage
  - Retinal injury
  - Presenting visual acuity
- **Injury- related Factors**
  - Type of injury
  - Cause/source of injury
- **Post traumatic infection**
- **Time interval between injury and presentation(delay of care)**
- **Treatment modality**

3.6 Operational definitions

Eye wall	Sclera and cornea
Closed globe injury	No full-thickness wound of eye wall
Open globe injury	Full-thickness wound of the eye wall
Blindness	Distance visual acuity (VA) of 3/60 – NLP in the injured eye
Delay of care	Eye care sought after 48 hours after injury

3.7 Sampling Procedure:

The medical records of all consecutive cases of globe injuries who presented to the department of ophthalmology, Gondar University Referral Hospital between September 2000 and February 2012 were identified and reviewed retrospectively**.** The list of 950 ocular trauma cases that were treated medically or surgically at the department of ophthalmology were identified and compiled from the operation theatre and the out patient department registration books. Only 245 cases that fulfilled the inclusion criteria were selected and reviewed retrospectively.

3.8 Data collection procedure:

A standardized data collection format which was prepared in English language based on the Birmingham Eye Trauma Terminology[35] and The United states Eye Injury Registry Model[36] was used to collect the required data from the medical charts of patients. The data were collected by one cataract surgeon, one ophthalmic officer and one optometrist who are currently working in the hospital. The visual outcome criteria was based on the WHO revised definition of visual impairment[37].

3.9 Data quality control:

To control data quality, a pretested data collection format was used. Revision and correction was made accordingly in a regular basis. A one day Training regarding the BETT classification of globe injuries was provided for data collectors. The principal investigator closely supervised the whole data collection process.

3.10 Data management and analysis:

After coding the data, EPI INFO 2002 was used for data entry and statistical analysis was carried out with Statistical Package for the Social Sciences (SPSS, V16). Binary Logistic regression analyses were conducted to determine the effect of different factors on the outcome variable and to control possible confounders. Factors with a p-value <0.2 in the bivariate analysis were entered in the multivariate analysis. Odds Ratio (OR) was used as a measure of association. A P-value of less - than 0.05 was considered statistically significant. The variables were entered to the multivariate model using the enter method.

4. ETHICAL CONSIDERATION

Ethical clearance was obtained from the Institutional Ethical Review Board of Gondar University. Permission was obtained from the Hospital administration of the university to carry out the study.

5. RESULTS

5.1 Socio demographics

A total of 245 cases were included in the study. The majority of cases (82.45%) were males with a male to female ratio of 4.7:1. The patients' age ranged from 4 years to 78 years with a median age of 22 years.Twenty-four per cent of cases were from Gondar town.Children under 16 years constitute almost one-third (34.7%) of all cases. Most injuries (80%) occurred in patients who were at the age of 30 years or under.

Table 1: Distribution of cases seen at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012

	n	(%)
Age Category		
4-15	**85**	**34.7**
16-27	**74**	**30.2**
28-39	**37**	**15.1**
>=40	**49**	**20.0**
Sex		
Male	**202**	**82.4**
Female	**43**	**17.6**
Residence		
Gondar town	**58**	**23.7**
Other	**187**	**76.3**

5.2 Characteristics of injury

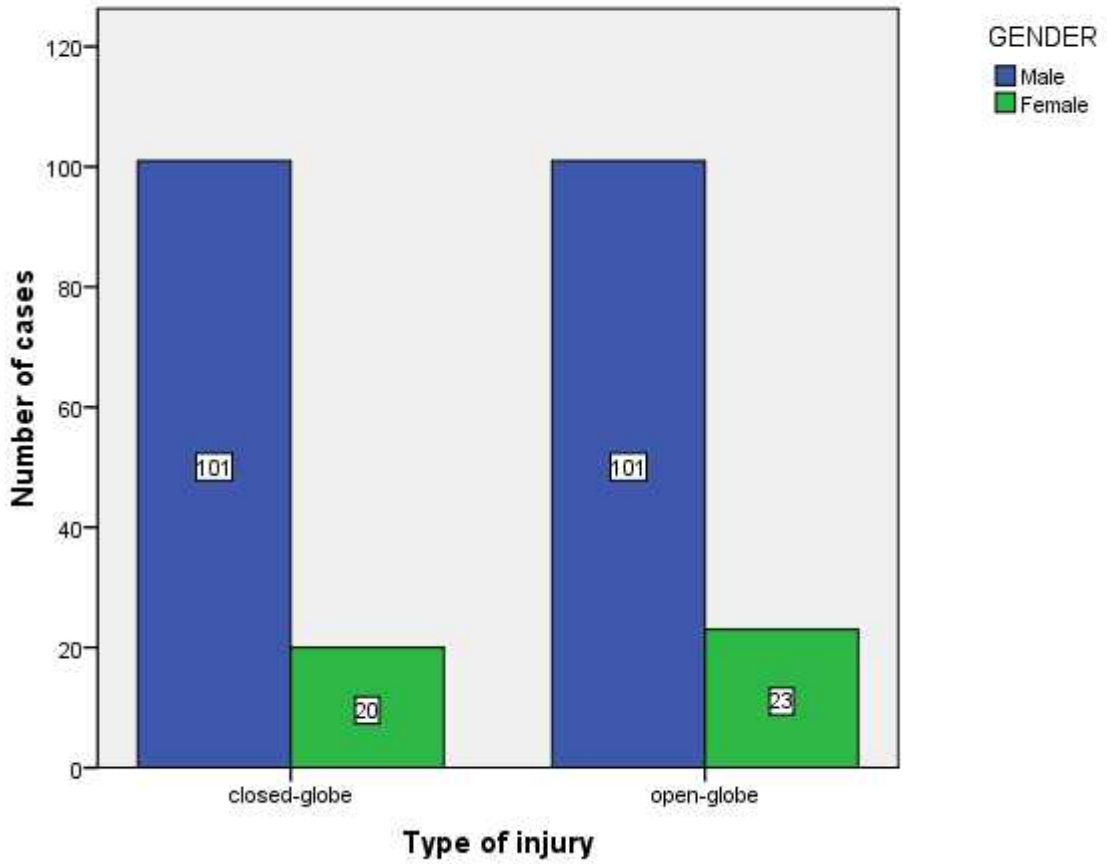
All cases had unilateral eye injury. Left eye is involved in just more than half of the cases (53.1%). The proportion of cases was almost equal for open and closed globe injuries, There were 124(50.6%) open globe and 121(49.4%) closed globe injuries.

Of those with open globe injury, corneal wound (penetration/rupture) was predominant

(50%).Corneoscleral (penetration/rupture) was diagnosed in 32(25.8%) cases. Two cases (1.6%) had IOFB. There was no case of perforating injury. Among cases with open globe injuries, prolapse of uveal tissue were diagnosed in 80(64.5%) cases. In total, 20(8.16%) cases had associated adenxal injury.

Gender difference was not statistically significant in open and closed type of injuries (P=0.68). At initial presentation synechea (anterior/posterior) was diagnosed in 18(7.3%), corneal scar in 7(2.9%), and corneal vascularization in 4(1.6%) cases.

Figure 1: Type of injury by gender of patients seen at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012



Injuries were commonly caused by wood (28%), stone (22%), metallic objects (7.3%), horn (3.7%), and fist (1.6%). The cause was not clearly stated for 80 cases (32.6%). Injury due to Wood and stone were common in patients who were under the age of 30. Assault

related injuries were found in 36 (14.7%) cases. In 41(16.7%) cases, injury was related to work, however data were not available regarding the occupation of patients.

Table 2:Distribution of Globe injuries among patients seen at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012

Type of Injury	n	%
Closed Globe Injury	121	49.4%
Corneal(penetration/rupture)	62	25.3%
Scleral(penetration/rupture)	17	6.9%
Corneoscleral(penetration/rupture)	32	13.1%
Limbal(penetration/rupture)	6	2.4%
Self-sealed corneal wound	5	2.0%
IOFB	2	.8%
Total	245	100.0%

IOFB- Intra Ocular Foreign Body

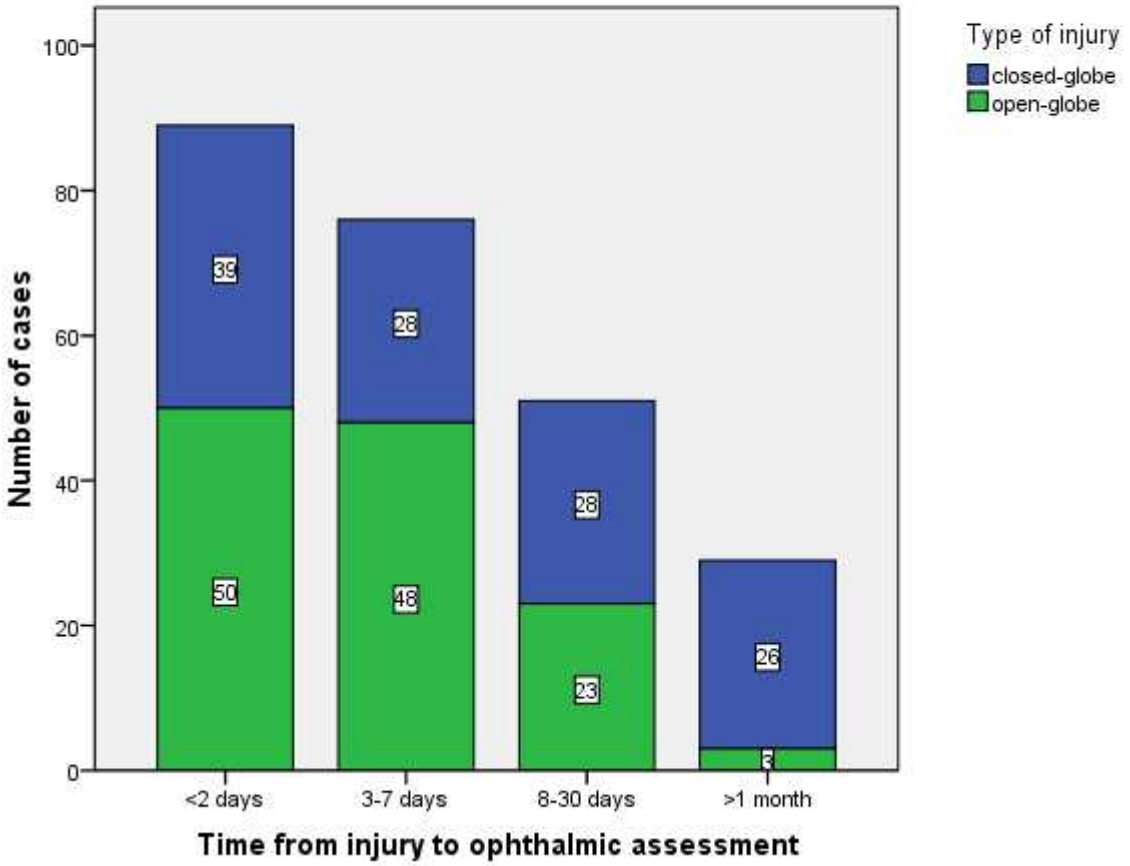
Table 3: Causes of injuries among patients treated at University of Gondar Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012(n=245)

Cause of injury	Frequency	Percent
Wood	78	31.8
Stone	59	24.1
Metal	26	10.6
Horn	9	3.7
Fist	6	2.44
Glass	4	1.6
Blast	2	.82
Bottle	2	.82
Fall	2	.82
Other	9	3.7
Unspecified	48	19.6

5.3 Time of presentation

The median time interval between the occurrence of injury and eye care was 4 days (Range: 1 to 365 days). Eighty-nine patients (36.3%) presented within two days, 76(31%) in one week, 51 (20.8%) in one month and the rest 29(11.8%) presented after a month (Figure 2).

Figure 2: Time from injury to ophthalmic assessment in patients treated at University of Gondar Referral Hospital,Northwest Ethiopia,between September 2008 and February 2012



5.4 Treatment Modalities and complications

Two hundred and one patients (82.1%) were treated surgically. Only 10(4.97%) cases underwent more than one surgery. Forty-four patients were treated medically on the out patient department. Of the open globe injuries, corneal repair was performed in 62(50%), sclera repair in 17(13.7%), corneoscleral repair in 32(25.8%), limbal repair in6 (4.8%),iris reposition in 10(8%), lid repair in 13(10.4%), IOFB removal in 2(1.61%) and evisceration in 16(12.9%)eyes. Of the closed globe injuries, corneal foreign body removal was performed in 20(16.5%) eyes. In both types of injuries, cataract extraction was performed in 101(41.2%) and hyphema removal in 2(8.16%) eyes. Intraocular lens was implanted for 99(40.4%) eyes.

5.5 Follow-up

The median follow up period was 34 days (1-582 days). The duration was longer for those with open type of injury. For posterior segment evaluation, B-scan ultrasound was performed for 18(7.35%) cases during their follow-up period. One case developed symphathetic ophthalmia during follow up. Data regarding the anatomical status of the eye at the last visit were available only for 43 cases: corneal scar in 22, phthisis bulbi in 2, posterior vitreous detachment In 1, and macula scar in 2 cases. The eye globe couldn't be saved in sixteen cases (6.53%).

5.6 Visual outcomes

In total at the initial visit, 35(14.3%) eyes had a visual acuity of 6/18 or better on Snellen chart, 23(9.4%) had a VA of <6/18 to >=3/60, 160(65.3%) had a VA of <3/60 to LP-, and for the remaining 27(11%) eyes the presenting VA was NLP. Of those with a presenting VA of 6/18 or better, 28(80%) of them were patients with a closed type of globe injury. On the other hand, out of the 27 cases that had a presenting VA of NLP, 21(77.8%) of them were patients with open globe injuries. Of 245 cases, 124 (50.6%) eyes achieved a VA of 3/60 or better in the injured eye. Only 31(12.65%) eyes attained a post treatment VA of 6/18 or better. In 43(35.5%) cases, the post treatment VA was no light perception. Of those who attained a post treatment VA of 6/18 or better, 81% of them were patients with closed type of injury. In general, the visual outcome was relatively better in closed globe injury.

Table 4: Type of injuries and visual outcomes of cases seen at University of Gondar Referral Hospital,Northwest Ethiopia,between September 2008 and February 2012

Type of injury	Visual outcome			
	Blind		Not blind	
	n	%	n	%
Closed Globe Injury	39	32.2%	82	66.1%
Corneal(penetration/ rupture)	41	33.9%	21	16.9%
Scleral(penetration/rupture)	13	10.7%	4	3.2%
Corneoscleral(penetration/rupture)	25	20.7%	7	5.6%
Limbal(penetration/rupture)	3	2.5%	3	2.4%
Self-sealed corneal wound	0	.0%	5	4.0%
IOFB	0	.0%	2	1.6%
Total	121	100.0%	124	100.0%

IOFB: Intraocular foreignbody

5.7 Factors associated with Visual outcome

On the bivariate analysis, type of injury, presenting VA, lens injury, hyphema, age, endophthalmitis, corneal abscess, residence, vitreous hemorrhage, synechea, time interval between the ocurrance of injury and presentation and treatment modality were found to have statistically significant association with visual outcome.

On the multivariate analysis, type of injury, presenting VA, age, vitreous hemorrhage, and synechea were found to be statistically and independently associated with post treatment visual acuity.

Poor presenting VA had an adverse effect on the visual outcome. Those with a presenting visual acuity of hand motion(HM**)** or worse had 10.1 times more likely to be blind on the affected eye as compared to those who had a presenting VA of better than HM(AOR=10.1, 95% CI [4.76, 21.45]).

Open-globe injuries were highly associated with poor visual outcome. Those who sustained an open type of injury were 4.11 times more likey to be blind in the injured eye as compared to those with closed globe injury(AOR=4.11, 95% CI, [1.92, 8.77]).

The visual outcome tended to be poor with increased age. There was a 74% reduction of blindness in the injured eye in Patients who were at 4 to 15 years were as compared to those at the age of 40 and above.Similarly those who were at the age of 16 to 27 had a 61% reduction of blindness in the injured eye as compared to those who were at the age of 40 and above.

Patients who had no vitreous hemorrhage had a reduced risk of becoming blind in the injured eye as compared to those with vitreous hemorrhage(AOR=0.044, 95% CI [0.003, 0.572]).

The presence of anterior or posterior synechea appeared to increase the risk of blindness in the injured eye (AOR= 3.61, 95% CI, [1.04 to 12.57]).

Table 5: Factors associated with visual outcome of eye injuries among patients treated at Gondar University Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012(result from logistic regression analyses).

Prognostic factors	Visual Outcome		95.0% C.I.for OR	
	Blind n (%)	Not blind n (%)	Crude OR	Adjusted OR
Residence				
Gondar town	20(16.5)	38(30.6)	.45[.24,.83]	.719[.301,1.715]
Other	101(83.5)	86(69.4)	1.00	1.00
Treatment modality				
Surgical	104(86.0)	97(78.2)	1.7[.87,3.32]	.669 [.224,1.994]
Medical	17(14.0)	27(21.8)	1.00	1.00
Endophthalmitis				
Yes	8(6.6)	1(.8)	8.71[1.07,70.7]	4.6 [.34,63.4]
No	113(93.4)	123(99.2)	1.00	
Keratitis (corneal abscess)				
Yes	7(5.8)	2(1.6)	3.75[.76,18.4]	2.85 [.44,18.6]
No	114(94.2)	122(98.4)	1.00	
Presenting VA				
=<HM	102(84.3)	42(33.9)	10.5[5.67,19.4]	10.1[4.76,21.45]**
>HM	19(15.7)	82(66.1)	1.00	
Time of presentation				
Delayed	85(85)	71(57.3)	1.76[1.04,3.0]	1.58 [.73, 3.41]
Not delayed	36(29.8)	53(42.7)	1.00	

NB. * = Remained significant at P-Value <0.05; OR: Odds Ratio
C.I: Confidence Interval

(Continued)Factors associated with visual outcome of eye injuries among patients treated at Gondar University Referral Hospital, Northwest Ethiopia, between September 2008 and February 2012(result from logistic regression analyses).

Prognostic factors		Visual Outcome		95.0% C.I.for OR	
		Blind n (%)	Not blind n (%)	Crude OR	Adjusted OR
Type of injury	OGI	82(67.8)	42(33.9)	4.11[2.4,7.0]	4.11 [1.92,8.77]**
	CGI	39(32.2)	82(66.1)	1.00	
Vitreous hemorrhage					
	yes	8(6.6)	1(.8)	1.00	1.00
	No	113(93.4)	123(99.2)	.115[.014,.93]	.044[.003,.572]*
synechea					
	Yes	13(10.7)	5(4.0)	2.9[.99,8.3]	3.612[1.038,12.57]*
	No	108(89.3)	119(96.0)	1.00	
Hyphema					
	Yes	28(23.1)	9(7.3)	3.85[1.7,8.6]	2.63[.895,7.726]
	No	93(76.9)	115(92.7)		
Age category					
	4-15	40(33.1)	45(36.3)	.7[.33,1.35]	.256[.095,.689]*
	16-27	29(24.0)	45(36.3)	.48[.23,1.01]	.389[.138,1.095]
	28-39	24(19.8)	13(10.5)	1.38[.57,3.3]	.898[.265,3.041]
	>=40	28(23.1)	21(16.9)	1.00	1.00

NB. * = Remained significant at P-Value <0.05; OR: Odds Ratio
**= Remained significant at P-Value < 0.0001; C.I: Confidence Interval

6. DISCUSSION

Eye injury is a significant cause of monocular blindness. This study revealed that large proportion of injuries (73.1%) occurred on those who were at the age of 30 or below particularly on males. This result is comparable with previous hospital based studies conducted in Ethiopia [12]and other countries [23, 24]. This predominance of males could be due to their occupation.

The result of this study shows that delayed presentation was higher compared to reports from previous studies[18, 22].The reason for delay of presentation might be due to socioeconomic status and lack of awareness.

In a previous study done in Ethiopia[18], the majority of injuries were caused by wood, metal, stone and fist. The result of this study also revealed that wood and stone was the common causes of eye injurys.

The post treatment visual acuity was not improved in significant number of cases. Of all cases, only 124 (50.6%) of them achieved a final visual acuity of 3/60 or better after treatment. The post treatment visual acuity of 6/18 or better was achieved only on 31 eyes (12.6%). In contrast to this, In a study from Queensland[23], out of 226 patients with open and closed type of injuries, 47.8% of eyes were reported to attain a final visual acuity of 6/12 or better. In previous study from Italy[15], a better visual outcome was achieved in a relatively large numbr of cases.This discrepancy might be due to difference in the quality of eye care service, the severity of injury or the characteristics of patients.

In the present study, the visual prognosis was found to be poor in patients with open globe injuries compared to those with closed globe injuries. Previous studies[23, 34] also revealed similar findings. Patients with closed globe and self-sealed corneal injuries were found to attain good visual outcome[34]. The result of this study also shows similar result.

Several prognostic factors like presenting VA, type of injury, hyphema, vitreous hemorrhage, post traumatic endophthalmitis, lens injury, iris injury, retinal injury, and ocular hypotony were known to be significant factors in previous studyies. In the present study**,**

type of injury, presenting VA, time interval between the occurrence of injury and eye care and age category were found to be statistically significant predictors of visual outcome in the multivariate analysis. On the other hand, the presence of hyphema[31], lens injury, iris injury[28], post traumatic infection[29] and retinal detachment[14] that were reported to be significant in other studies turned out to be non significant. This discrepancy could be due to the difference in the number of cases.

Poor presenting visual acuity was found to have significant association with poor visual outcome (AOR=10.1, 95%CI [4.76, 21.45]). Patients that sustained an open globe injury had 4.1 times more likely to be blind as compared to those with a closed injury (AOR=4.11, 95%CI [1.92, 8.77].

The presence of full chamber hyphema that was reported to have an adverse effect on the visual outcome [14],didn't show significant association in the multivariate analysis in this study.The reason might be due to the difference in the severity of hyphema and the number of cases with this ocular condition.

Post traumatic endophthalmitis was known to be significant predictor of poor visual outcome in previous studies [29]. It was also found to be statistically significant in the bivariate analysis in the present study. Since the case was diagnosed only in 9 patients, it didn't appear to be significant in the multivariate analysis.

7. LIMITATIONS AND STRENGTH OF THE STUDY

- Limitations of the study

One of the limitations of this study is that**,** since it is a retrospective study there might be a possibility of recording bias. The other limitation is that the effect of different prognostic factors that were known to predict the post treatment visual outcome like ocular hypotny and mechanism of injury could not be assessed in the present study due to unavailability of data from the patient's medical chart.

- Strength of the study

Despite the above limitations, the present study determined prognostic factors that can help predict the visual outcome of patients after controlling possible confounders which hasn't been studied before in the study area.

8. CONCLUSION

- Eye injuries can occur in all individuals; however there is variation by age and gender.
- The visual recovery of globe injury is poor
- Open globe injuries significantly cause blindness.
- Presenting visual acuity and type of injury are the most important predictors of visual outcome

9. RECOMMENDATIONS

To prevent the visual loss resulting from eye injuries and to meet the goal of VISION2020, greater attention should be given to the prevention aspect by the responsible bodies.

- **To Ministry of health and Non- governmental organizations**
  - Since the consequence of globe injury is devastating,emphasis should be given on the prevention of eye injuries by creating awareness on the impact and preventive measures of eye injuries towards the community through mass Medias using Radio and television
  - Focus on strengthening primary eye care service

- **For researchers:**
  - Further study on the prognostic factors of globe injuries with a prospective study design and adequate study subjects should be conducted.

10. REFERENCES

1. Mallika P, et al. Pattern of Ocular Trauma in Kuching, Malaysia. Malaysian Family Physician. 2008; 3(3):140-145.
2. El-Sebaity DM, et al. Pediatric eye injuries in upper Egypt. Clinical Ophthalmology. 2011; 5:1417-1423.
3. Mulugeta A,Bayu S. Pattern of perforating ocular injuries at Menelik II hospital, Addis Ababa. Ethiop. J. Health Dev. 2001; 15(2):131-137.
4. Singh DV. et al. Profile of Ocular Trauma at Tertiary Eye Centre. JK SCIENCE. 2005; 7(1): 1-6.
5. Négrel A,Thylefors B. The global impact of eye injuries. Ophthalmic Epidemiol. 1998; 5(3): 143-69.
6. Gyasi ME,Amoaku WMK,Adjuik MA. Epidemiology of Hospitalized Ocular Injuries in the Upper East Region of Ghana. Ghana Medical Journal. 2007; 41(4):171-175.
7. Kanoff JM, et al. Characteristics and Outcomes of Work-Related Open Globe Injuries. Am J Ophthalmol. 2010; 150:265-269.
8. Oluyemi F. Epidemiology of Penetrating Eye Injury in Ibadan: A10-Year Hospital Based Review. Middle East African Journal of Ophthalmology. 2011; 18(2):159-163.
9. Chang C-H, et al. Hospitalized eye injury in a large industrial city of South-Eastern Asia. Graefes Arch Clin Exp Ophthalmol. 2008; 246:223-228.
10. Eye Injuries: Recent Data and Trends in the United States.Accessed on 19/02/2012. Available from: www.aao.org/practice_mgmt/eyesmart/snapshot.cfm.
11. Jahangir T, et al. Pattern of Presentation and Factors Leading to Ocular Trauma. Pak J Ophthalmol. 2011; 27(2):96-102.
12. Bejiga A. Causes and Visual Outcomes of Perforating Ocular Injuries among Ethiopian Patients. Community Eye Health. 2001; 14(39):45-46.
13. Alvi RH, et al. Visual Outcome and Pattern of Industrial Ocular Injuries. Pak J Ophthalmol. 2011; 27(1): 8-11.
14. Gothwal V, et al. Demography and prognostic factors of ocular injuries in South India. Australian and New Zealand Journal of Ophthalmology. 1999; 27:318-325.
15. Cillino S, et al. A five-year retrospective study of the epidemiological characteristics and visual outcomes of patients hospitalized for ocular trauma in a Mediterranean area. BMC Ophthalmology. 2008; 8(6):1-9.
16. Soliman MM,Macky TA. Pattern of ocular trauma in Egypt. Graefes Arch Clin Exp Ophthalmol. 2008; 246:205-212.
17. Wang JD, et al. Prevalence and incidence of ocular trauma in North China:the Beijing Eye Study. Acta Ophthalmologica. 2012; 90:61-67.
18. Asaminew T,Gelaw Y,Alemseged F. A 2-Year Review of Ocular Trauma in Jimma University Specialized Hospital. Ethiop J Health Sci. 2009; 19(2):67-74.
19. Addisu Z. Pattern of ocular trauma seen in Grarbet Hospital, Butajira,Central Ethiopia. Ethiop J. Health Dev.2011; 25(2):150-155.
20. Grieshaber M,Stegmann R.Penetrating eye injuries in South African children:aetiology and visual outcome. Eye. 2006; 20:789-795.
21. McGwin G,Owsley C. Incidence of Emergency Department–Treated Eye Injury in the United States. Arch Ophthalmol. 2005; 123:662-666.
22. Shah M,Shah S,Khandekar R. Ocular injuries and visual status before and after their management in the tribal areas of Western India-A historical cohort study. Graefes Arch Clin Exp Ophthalmol. 2008; 246:191-197.
23. Smith AR,O'Hagan SB,Gole GA. Epidemiology of open- and closed-globe trauma presenting to Cairns Base Hospital, Queensland. Clinical and Experimental Ophthalmology. 2006; 34:252-259.

24. ALTINTAŞ L, et al. Pattern of open eye injuries in northwest Turkey:a retrospective study. Turkish Journal of Trauma & Emergency Surgery. 2011; 17(4):334-339.
25. Thompson C, et al.Penetrating eye injuries in rural New South Wales. Australian and New ZealaMd Journal of Opbtbalmology.1997. 25:37-41.
26. Agrawal R, et al. Prognostic factors for vision outcome after surgical repair of open globe injuries. Indian J Ophthalmol. 2011; 59:465-470.
27. GP M, L X,DO B. Prognostic factors in open eye injury managed with vitrectomy: retrospective study. Croat Med J. 2004; 45(3):299-303.
28. Knyazer B, et al. Prognostic factors in posterior open globe injuries(zone-III injuries).Clinical and Experimental Ophthalmology. 2008; 36:836-841.
29. UNVER YB, et al. Prognostic factors in severely traumatized eyes with posterior segment involvement. Turkish Journal of Trauma & Emergency Surgery. 2009; 15(3):271-276.
30. Lee C-H, et al. Prognostic indicators of open globe injuries in children. American Journal of Emergency Medicine. 2009; 27:530-535.
31. S S, W R. Predictive factors of visual outcome in open globe injuries in Thailand: a prospective study. Asian Biomedicine.2011; 5(2):289-294.
32. Khatry SK, et al. The epidemiology of ocular trauma in rural Nepal. Br J Ophthalmol. 2004; 88:456-460.
33. Man C.Y.W,Steel D. Visual outcome after open globe injury: a comparison of two prognostic models-the Ocular Trauma Score and the Classification and Regression Tree. Eye. 2010; 24:84-89.
34. Soylu M,Sizmaz S,Cayli S. Eye injury (ocular trauma) in southern Turkey:epidemiology, ocular survival, and visual outcome. Int Ophthalmol. 2010; 30:143-148.
35. Kuhn F, et al. The Birmingham Eye Trauma Terminology system(BETT). J Fr. Ophtalmol. 2004; 27(2):206-210.
36. United States Eye Registry. Accessed on 19/02/2012.Available from: http://www.useironline.org.
37. Change the Definition of Blindness.Accessed on 22/03/2012. Available from: http://www.who.int/entity/blindness/change

11. ANNEXES

Appendix *1: Data collection format*

Part I: Distribution of Characteristics of cases

Circle the letter of choice and say Data Not Available (DNA) if there is missed data.

Patient's Chart No.:_____ Address---------- Date of initial visit----------

s.no.	Variable	Description/category
1	Age (years) at the time of injury	
2	Sex	1. Male 2. Female
3	Occupation	
4	Residence	
5	Month of injury occurred	
6	Prior Ocular history on the injured eye	1. Intraocular surgery 2. Medical diseases(specify)
7	Time interval from the occurrence of injury to presentation	
8	Cause of injury	1. Work related 6. Explosion 2. Assault 7. Gunshot 3. Road traffic accident 8. Chemical 4. Fall 9. Other(specify) 5. Firework
9	Application of traditional medicine	1. Yes 2. No
10	Hospitalization	1. Yes 2. No
11	Treatment given	1. Medical 2.Surgical
12	Duration of follow-up	

Part II: Clinical characteristics of cases

s.no.	Variable	Description/category
1	Initial visual acuity	Injured eye Pin hole---------- Fellow eye Pin hole----------
2	Intraocular pressure	Injured eye---------- Fellow eye---------
3	Type of injury	1. Penetrating 5. Contusion 2. Perforating 6. Lamellar Laceration 3. IOFB 7. Other(specify) 4. Globe rupture
4	Eye lid laceration	1. Yes 2. No
5	Injury of eye wall	1. Corneal tear 3. Corneal abrasion 2. Scleral tear 4. Corneoscleral tear
6	Intraocular factors	1. Hypheama 2. Iris damage(prolapse /iridodialysis) 3. Lens damage(cataract/dislocation/subluxation) 4. RAPD 5. Vitreous hemorrhage 6. Retinal injury(detachment/tear/hemorrhage) 7. Choroidal rupture 8. Other (specify)
7	Post traumatic infection	1. Endophthalmitis 2.Corneal abscess
8	Post-operative CXN	
8	Final visual acuity	Injured eye ------- Fellow eye ------

Collected by: ---------- Date---------- Sign. ----------

Appendix 2: Information sheet

Title of the project: Assessment of patterns and visual outcomes of ocular injuries
Name of Investigator: Sisay Yoseph
Name of Advisor: Dr. Berihun Megabaw

Name of the Organization: University of Gondar, College Of Medicine and Health Sciences.
Name of the Sponsor: University of Gondar
Introduction: This information sheet is prepared for Gondar University Referral Hospital Administration. The aim of this form is to make the above body clear about the purpose of this research project, data collection procedures and to get permission to undertake the research.

Purpose of the project: the purpose of this project is to determine patterns of eye injuries and associated factors of visual outcomes in patients with eye injuries who were treated at Gondar University Referral Hospital, North-West Ethiopia.
Procedure: this study uses a retrospective review of medical charts of patients
Risk and /or Discomfort: no risk will arise to individuals whom medical document will be reviewed. The collected data will not be transferred to other bodies.
Benefits: This research will provide information for stakeholders who are involved in the prevention and management of visual impairment due to ocular injuries. Therefore, the intervention that follows from this research will benefit the community as a whole.
Confidentiality: the name of the patients will not be recorded while collecting the data. Any collected data will be kept confidential and accessed only by the researcher and his assistants.
Persons to contact: this research project will be reviewed and approved by the institutional review board of college of medicine and health sciences, University of Gondar. If in case you want to know more information about the research and its undertakings, you may contact the committee through the address of the advisors and/or the principal investigator below.

Advisor:

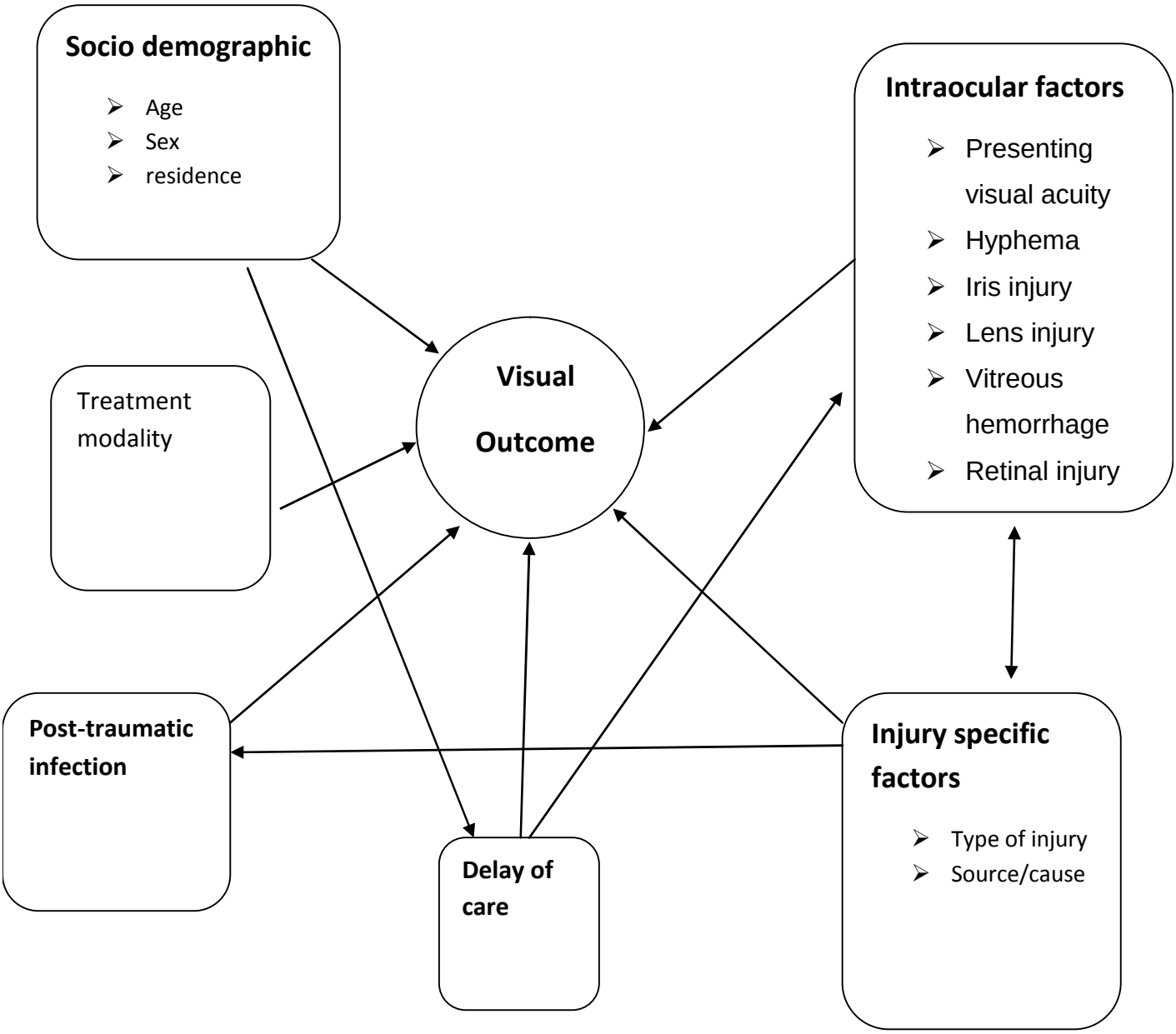
1. **Dr.Berihun Megabiaw,** University of Gondar, college of medicine and health sciences, Institute of public health

   Tel: +251-912-127173 e-mail: beredomega@gmail.com

Principal Investigator: Sisay Yoseph

Tel: +251-912-160249 e-mail: sisayjoseph@ymail.com

Appendix 3: Conceptual framework



Appendix 4: Declaration

I, the undersigned, final year MPH student declare that this thesis is my original work in partial fulfillment of the requirement for the degree of Master of public health.

Name: Sisay Yoseph

Signature: _____

This thesis has been submitted for examination with my approval as advisor:

Dr. Berihun Megabiaw (MD, MPH) Signature: _____

Place of submission: Institute of public Health, College of Medicine and Health Sciences, University of Gondar, May, 2012

Date of Submission: _____